DOCUMENT-IDENTIFIER: US 5942347 A
TITLE: Proton exchange membrane fuel cell separator plate

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BSPR:
Bi-polar separator plates for use in proton exchange membrane cells constructed
of graphite or resin-bonded graphite carbon composite materials and having gas
flow channels are taught by U.S. Pat. No. 4,175,165. This patent also teaches the treatment of the bi-polar separator plates by coating the surfaces with a wetting agent, such as colloidal silica sols, to render the surfaces thereof hydrophilic. In this way, water generated in the fuel cell is attracted away from the electrodes for subsequent disposition. However, coating the surfaces with a wetting agent undesirably increases the electrical resistance across the plate, resulting in reduced conductivity. U.S. Pat. No. 3,634,569 teaches a method of producing dense graphite plates from a mixture of powder graphite and a thermosetting resin for use in acid fuel cells. The method employs a mixture, by weight, of 5% to 25% thermosetting
phenolic resin binder and 75% to 95% sized powdered graphite. Graphite and
resin bi-polar plates are also taught by U.S. Pat. No. 4,339,322 (a bi-polar plate comprised of molded thermoplastic fluoropolymer, graphite and carbon fibers), U.S. Pat. No. 4,738,872 (separator plates comprising 50 weight percent graphite and 50 weight percent thermoset phenolic resin), U.S. Pat. No. 5,108,849 (serpentine flow panels in a fuel cell separator plate composed of non-porous graphite or other corrosion resistant metal powders and thermoplastic resin, such as polyvinylidene fluoride, in a composition of 10-30
weight percent resin and 70-90 weight percent graphite powder), U.S. Pat. No.

4,670,300 (a fuel cell plate comprising 20% to 80% graphite with the balance being cellulose fibers or cellulose fibers and thermosetting resin in equal proportions), U.S. Pat. No. 4,592,968 (separator plate comprised of graphite,
coke and carbonizable thermosetting phenolic resin which are then graphitized
at 2650.degree. C.), U.S. Pat. No. 4,737,421 (fuel cell plate from carbon or graphite in the range of 5% to 45%, thermosetting resin in the range of 40% to
80%, with the balance being cellulose fibers), U.S. Pat. No. 4,627,944 (fuel cell plate from carbon or graphite, thermosetting resin and cellulose fibers), U.S. Pat. No. 4,652,502 (fuel cell plate made from 50% graphite and 50% thermosetting resin), U.S. Pat. No. 4,301,222 (separator plate made from a mixture of 40% to 65% graphite and 35% to 55% resin), and U.S. Pat. No. 4,360,485 (separator plate made from a mixture of 45% to 65% graphite and 35%
to 55% resin).

DEPR:
In accordance with a particularly preferred embodiment of this invention, the bi-polar separator plate comprises at least one electronically conductive material in an amount in a range of about 50% to about 95% by weight of the separator plate, at least one resin in an amount of at least about 5% by weight of the separator plate, and at least one hydrophilic agent. In accordance with a particularly preferred embodiment of this invention, the separator plate is formed from a composition comprising a mixture of about 50 to 95 weight percent
graphitic material, graphite, about 5 to about 30 weight percent of a type of thermosetting resin, 0 to about 45 weight percent carbon fibers, and 0 to about
25 weight percent silica. This composition is then molded at an elevated temperature in a range of about 250.degree. F. to about 800.degree. F. and a pressure in a range of about 500 psi to about 4,000 psi. The conductivity of the molded material produced in this fashion is at least about 5 S/cm which represents the nominal minimum conductivity required for use in a proton exchange membrane fuel cell. The porosity of the molded material may be up

to
about 25% void volume. The bubble pressure of the molded material which increases with decreases in void volume of the plate is at least about 5 psig.

DOCUMENT-IDENTIFIER: US 4929404 A
TITLE: Graphitic or carbonaceous moldings and processes for producing the same

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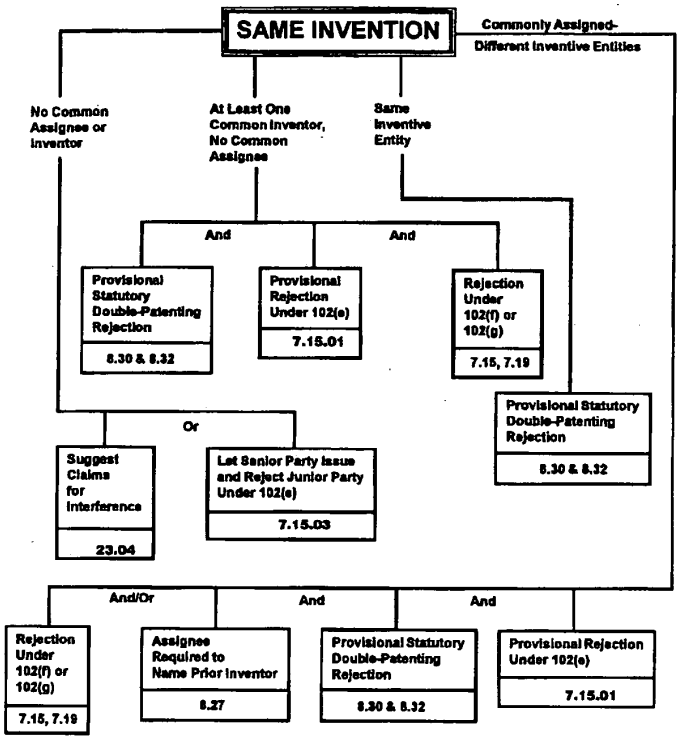
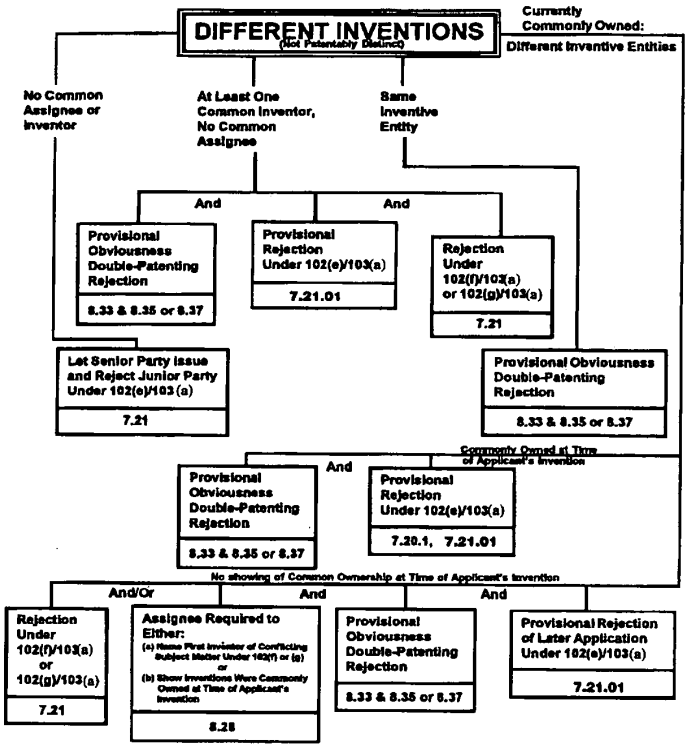
BSPR:
As a gas impermeable carbon material to be used for a gas separator in a fuel cell, a glassy carbon material has hitherto been proposed. For example, in Japanese Patent Laid-Open Publication No. 150275/1983, an example of using a
glassy carbon alone is described, and in Japanese Patent Laid-Open Publication
No. 72273/1982, carbonization (1,000.degree. C.) of a green molding of graphite and phenol resin is carried out for a long period of 168 hours with application of a certain load on the molding, and further the temperature is elevated up to 2,800.degree. C. over 48 hours to obtain a graphitized separator. Also, in Japanese Patent Laid-Open Publication No. 127377/1984, a
material with a thickness after calcination of 0.1 to 1 mm, obtained from furan
resin to which ultra-fine carbon black powder has been added and admixed according to necessity by molding to a desired thickness, and then curing at room temperature, is placed between graphite plates or the like of excellent thermal conductivity with form-retaining characteristics and is carefully calcined for uniform calcination to obtain a glassy carbon thin plate.

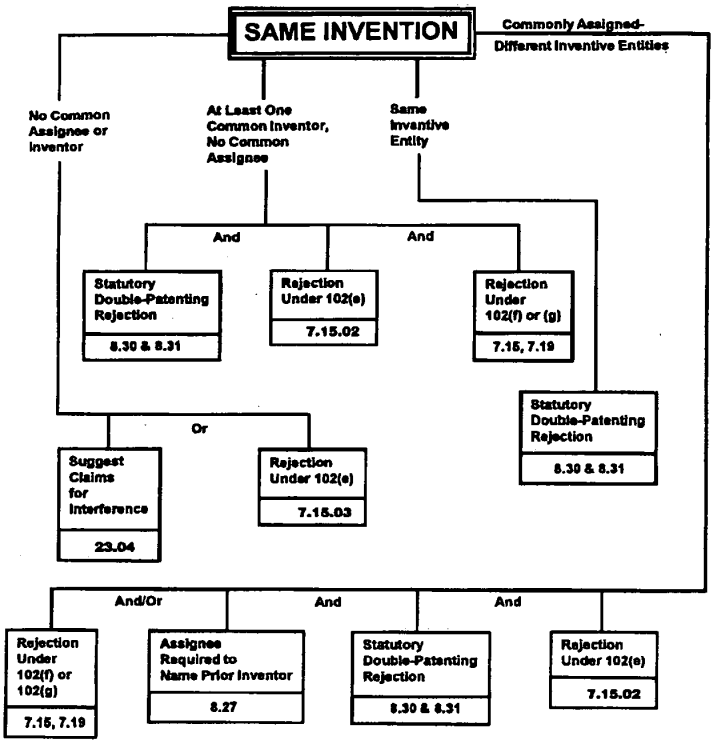
CONFLICTING CLAIMS BETWEEN: TWO APPLICATIONS — **CHART I-A**



CONFLICTING CLAIMS BETWEEN: TWO APPLICATIONS — **CHART I-B**



CONFLICTING CLAIMS BETWEEN: APPLICATION AND A PATENT — **CHART II-A**



CONFLICTING CLAIMS BETWEEN: APPLICATION AND A PATENT — **CHART II-B**